

WHAT IS CLAIMED IS:

- 1                   1.       A tool guide for guiding an end effector of a robotically  
2       controllable surgical instrument from a position outside a patient body to a position in  
3       close proximity to a surgical site within the patient body, the end effector being mounted  
4       at an end of a shaft of the surgical instrument, the tool guide comprising:  
5                   a guide body;  
6                   a seat formation on the guide body, the seat formation being arranged to  
7       seat in an aperture leading into the patient body so as to mount the tool guide on the  
8       patient body; and  
9                   a sheath formation on the guide body, the sheath formation defining a  
10      passage, an inlet leading into the passage and an outlet leading from the passage, the  
11      sheath formation being arranged to cooperate with the seat formation such that when the  
12      seat formation is seated in the aperture, the outlet is positionable in close proximity to the  
13      surgical site, thereby to enable the end effector to be guided to a position in close  
14      proximity to the surgical site by passing it through the inlet, along the passage and out  
15      from the outlet, so as to emerge from the outlet at the position in close proximity to the  
16      surgical site.
- 1                   2.       The tool guide of claim 1, wherein the sheath formation comprises  
2       a round cylindrical tubular portion, at least part of the passage being defined within the  
3       tubular portion.
- 1                   3.       The tool guide of claim 2, wherein the tubular portion has an  
2       axially extending circumferential inner surface defining at least part of the passage, the  
3       inner surface having a diameter falling in the range between about 3 mm and about 20  
4       mm.
- 1                   4.       The tool guide of claim 3, wherein the inner surface has a diameter  
2       of about 5 mm to 12 mm.
- 1                   5.       The tool guide of claim 2, wherein the tubular portion has an outer  
2       diameter falling in the range between about 3 mm and about 12 mm.
- 1                   6.       The tool guide of claim 5, wherein the tubular portion has an outer  
2       diameter of about 6 mm to 16 mm.

1                    7.        The tool guide of claim 2, which further comprises a stop on the  
2        guide body, the stop being arranged to seat against the patient body when the seat  
3        formation is seated in the aperture.

1                    8.        The tool guide of claim 7, wherein the seat formation is defined by  
2        an outer surface of a round cylindrical tubular portion.

1                    9.        The tool guide of claim 8, wherein the stop comprises a stop flange  
2        protruding radially outwardly from the round cylindrical tubular portion.

1                    10.      The tool guide of claim 8, wherein the round cylindrical tubular  
2        portion defining the seat formation is defined by part of the round cylindrical tubular  
3        portion defining the sheath formation.

1                    11.      The tool guide of claim 10, wherein the sheath formation has a  
2        length extending between the stop and an opposed end of the sheath formation, at which  
3        the outlet is defined, falling in the range between about 25 mm and about 250 mm.

1                    12.      The tool guide of claim 8, wherein the round cylindrical tubular  
2        portion of the sheath formation is separate from the round cylindrical tubular portion  
3        defining the seat formation and the round cylindrical portion of the sheath formation is  
4        axially displaceably received in the round cylindrical tubular portion defining the seat  
5        formation.

1                    13.      The tool guide of claim 12, which comprises a sheath stop on the  
2        round cylindrical tubular portion of the sheath formation, the sheath stop being arranged  
3        to abut against the tubular portion defining the seat formation so as to inhibit the sheath  
4        formation from being axially displaced relative to the round cylindrical tubular portion  
5        defining the seat formation beyond a predetermined distance.

1                    14.      The tool guide of claim 13, in which the sheath stop comprises a  
2        sheath flange.

1                    15.      The tool guide of claim 13, wherein the sheath formation has a  
2        length extending between the stop on the tubular member defining the seat formation and  
3        an opposed end of the sheath formation, at which opposed end the outlet is defined,

4 falling in the range between about 25 mm and about 250 mm, when the sheath stop abuts  
5 against the tubular member defining the seat formation.

1 16. The tool guide of claim 1, wherein at least the sheath formation is  
2 made from a resiliently deformable material.

1 17. A tool guide kit for use in guiding an end effector of a robotically  
2 controllable surgical instrument from a position outside a patient body to a position in  
3 close proximity to a surgical site within the patient body, the end effector being mounted  
4 at an end of a shaft of the surgical instrument, the tool guide kit comprising

5 a plurality of tool guides, each tool guide comprising  
6 a guide body;

7 a seat formation on the guide body, the seat formation being  
8 arranged to seat in an aperture leading into the patient body so as to mount the tool guide  
9 on the patient body; and

10 a sheath formation on the guide body, the sheath formation  
11 defining a passage, an inlet leading into the passage and an outlet leading from the  
12 passage; and

13 the plurality of tool guides including guides having sheath formations of a  
14 variety of different lengths falling in the range between about 25 mm and about 250 mm  
15 so that a tool guide having a sheath formation length corresponding to a distance between  
16 the aperture in the patient body and the surgical site can be selected from the tool guide  
17 kit so that when the selected tool guide is mounted on the patient body, its sheath  
18 formation can be positioned such that its outlet is in close proximity to the surgical site,  
19 thereby to enable the end effector to be guided to a position in close proximity to the  
20 surgical site by passing it through the inlet, along the passage and out from the outlet, so  
21 as to emerge from the outlet at the position in close proximity to the surgical site.

1 18. A tool guide comprising:

2 an elongate body defining opposed ends and a passage extending  
3 longitudinally along the body between the opposed ends; and

4 an engaging formation on the body, the engaging formation being  
5 arranged to cooperate with a complementary engaging formation on a robotic arm, so that  
6 the tool guide can be mounted in an aperture leading into a patient body and the robotic  
7 arm can be coupled to the tool guide while the tool guide is mounted in the aperture.

1                   19.     The tool guide of claim 18, wherein the engaging formation  
2 comprises a socket formation.

1                   20.     The tool guide of claim 19, wherein the socket formation is defined  
2 within the passage of the tool guide.

1                   21.     The tool guide of claim 20, which comprises an inlet which leads  
2 into the passage, the inlet being arranged to be accessible from outside the patient body  
3 when the tool guide is mounted in the aperture, the socket formation being positioned  
4 adjacent the inlet; and  
5                   an outlet which leads from the passage, the outlet being arranged to be  
6 positioned within the patient body when the tool guide is mounted on the patient body.

1                   22.     The tool guide of claim 21, wherein the socket formation  
2 comprises a circumferentially extending surface defining at least part of the passage, the  
3 surface tapering radially inwardly in a direction away from the inlet.

1                   23.     The tool guide of claim 22, which comprises an outer surface  
2 arranged to be seated in the patient body, the outer surface defining at least one gripping  
3 formation arranged to be gripped by tissue when the tool guide is mounted on the patient  
4 body.

1                   24.     The tool guide of claim 23, wherein the at least one gripping  
2 formation comprises a rib extending helically around the outer surface.

1                   25.     The tool guide of claim 23, wherein the at least one gripping  
2 formation comprises a plurality of ribs extending around the outer surface.

1                   26.     The tool guide of claim 18, which further comprises a sealing  
2 formation sealingly covering the inlet, the sealing formation being arranged to permit the  
3 engaging formation of the robotic arm to pass therethrough.

1                   27.     The tool guide of claim 26, wherein the sealing formation is at least  
2 partially formed from a synthetic plastics material.

1                   28.     The tool guide of claim 27, wherein the sealing formation is at least  
2 partially formed from silicone.

1                   29.     The tool guide of claim 18, wherein the elongate body is at least  
2 partially made of steel.

1                   30.     The tool guide of claim 18, which comprises a cross-sectionally  
2 circular tubular portion defining the outlet.

1                   31.     The tool guide of claim 30, in which a wall of the cross-sectionally  
2 circular tubular portion tapers radially outwardly in a rearward direction away from the  
3 outlet.

1                   32.     A method of preparing for the operation of tools actuated by  
2 robotic arms in a surgical procedure, the method comprising:

3                   determining a plurality of port locations on a patient's body surface for  
4 tool insertion;

5                   making an incision in at least two of the determined port locations; and

6                   inserting a tool guide in at least two of the incisions, the tool guide  
7 including an insertion aperture and a sealing formation configured to seal the aperture.

1                   33.     The method of claim 32, wherein the plurality of ports is a greater  
2 number than the number of robotic arms to be employed in the surgical procedure.